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ABSTRACT

The relationship between aspects of mother-infant interactional behavior (vocalization, smiles, mutual eye contact, and facing position) and the infant's developmental level was investigated through both observation and intervention efforts. A sample of 33 primiparous mothers (mean CA of 22 years) from low income families and their infants (mean CA of 8 months) were videotaped during interactions with each other. Analysis showed that maternal position during interaction (facing, partially facing, or behind the infant) was strongly related to the frequency of maternal interactional behavior and indices of infant language and cognitive development. Intervention to teach mothers to use the facing position showed that change in position was related to increases in both maternal interactional behavior and infant development. The intervention involved use of the videotapes, informal discussion and role play activity. The results were considered relevant for intervention with infants at risk for developmental delay, abuse, and neglect. (Author/SS)

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Intervention to Improve Mother-Infant Interaction and Infant Development

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Abstract

Thirty-three infants at risk for developmental delay were videotaped interacting with their mothers. Analysis showed that maternal position during interaction (facing, partially facing, or behind the infant) was strongly related to the frequency of maternal interactional behavior and indices of infant language and cognitive development. Intervention to teach mothers to use the facing position showed that change in position was related to increases in both maternal interactional behavior and infant development. The results were considered relevant for intervention with infants at risk for developmental delay, abuse, and neglect.

Intervention to Improve Mother-Infant Interaction and Infant Development

Methods for delineating the intricacies of early mother-infant interaction have been developed by Stern (1971; 1974), Brazelton, Koslowski, and Main (1974), and Condon and Sander (1974). These techniques have been applied to a small number of normal, middle class dyads. The result of these probes into interactional style or pattern has been the conclusion that, while some features of interaction apply to most dyads, different dyads show qualitatively different patterns of interaction. The clinical observation has been that some of these patterns are related to poor mother-infant relationships. However, the ideas of qualitatively different patterns has not been pursued sufficiently to be applied in early intervention programs. One reason is that the techniques of analysis are extremely time consuming and have, thereby, limited each study to a few dyads. Another is that there is an infinite variaty of interaction patterns which could be identified with such fine-grained methods. In order to apply interactional analysis to intervention, it will be necessary to identify a limited set of relevant variables that define the qualitative differences in mother-infant interactions.

Another factor limiting the applicability of the current studies of interactional analysis is that most studies have focused on white, middle-class dyads. Moreover, no studies have involved infants who were more than six months old. Because intervention programs often serve a disproportionate number of lower class and black families with a wide age

range of infants, there is a need to identify the interaction patterns of these groups.

Despite these limiting factors, some of the findings of previous studies should be considered at least tentatively as hypotheses for work with high risk families. Most basic is the assumption that qualitative differences in interactions do exist and that they do have impact on the infant's development. The work of Condon and Sander (1974) strongly suggested that infants could be responsive to these differences immediately following birth. Using very different methods Blehar, Leiberman, and Ainsworth (1977) have found stability of maternal behavior across the first year of life. If this is so, it becomes reasonable to think of interaction patterns as having some stability in spite of the developmental change of the infant. Blehar et al. (1977) point to maternal sensitivity and responsiveness as differentiating qualitative factors. The work of Brazelton et al. (1974) and Stern (1971; 1974) would tend to support this.

While most of the developmental research has focused on a limited number of very young middle class subjects, the programs for disadvantaged children have emphasized longitudinal outcomes for much larger groups. Early

intervention through the parent has been found to be most effective (Bronfenbrenner, 1974). Because these programs involved providing age-appropriate learning materials and modeling their use, it has sometimes been assumed that the primary effects were achieved through increasing the time the infant and mother spent together in developmentally stimulating activities (Gordon, 1969; Madden, Levenstein, and Levenstein, 1976). However, it is also possible that significant changes took place in the interaction patterns of the dyads as a result of the mothers' observing, and then practicing, the model's interactional behavior. If changes in interaction pattern are the result of these interventions, this would be likely to affect most of the dyad's behavior and not just the time spent in the prescribed activity. Moreover, such changes would tend to be maintained even after the instruction (and the provision of new toys) had been discontinued. Finally, interactional skills learned with one infant might be generalized to younger siblings. These three outcomes are cited by Bronfenbrenner (1974) as resulting from the best early intervention programs. Thus, it seems possible that qualitative changes in interactional style may account for some of the developmental increases attributed to

the use of educational activities.

This hypothesis formed the basis of the four month intervention program reported here. Mothers of severely disadvantaged infants met weekly in a group to learn to analyze and change their own interaction patterns. Videotapes of each dyad were taken and shown to the mothers at each meeting. Two of the most immediate problems were to identify qualitative differences and to explain these differences to the mothers. The techniques of micro-analysis were clearly too complicated for the mothers and too time-consuming for the staff. A simple approach was needed. Maternal position (facing, partially facing, and behind) relative to the child during interaction appeared to control many of the more complex aspects of the interactions. A pilot study (Crittenden and Snell, Note 1) indicated that less than a third of the mothers spontaneously chose to face their infant during play interaction. This suggested that face-to-face interaction may not have been a common experience for these dyads. Because the previous studies had considered only instances of face-to-face communication, it was not possible to know how unusual these results were. Nevertheless, since both mothers and infants seemed more active in the facing position and since mothers appeared consistent in their

choice of position, two hypotheses were formed and tested. First, it was expected that facing position mothers would use the most interactional behavior and behind position mothers the least. In addition, the infants of facing position mothers would have the highest developmental quotients and those of behind position mothers the lowest quotients. Second, it was expected that improvement in the mother's position would be related to increases in the frequencies of her interactional behavior and in her infant's developmental rate.

Method

Subjects

A sample of 33 primiparous mothers and their infants participated in the study. The mothers had been referred to the intervention program through welfare and health departments and hospital clinics. All the mothers were from low income families in an urban or adjacent rural setting. They had a mean chronological age (CA) of 22 years, which ranged from 15 to 49 years. Although the mothers averaged 9.8 years of school, one quarter were mildly retarded and had received special education. Two-thirds of the mothers were unmarried. A different two-thirds were receiving protective services for suspected abuse or neglect of their children.

Racially the mothers were evenly divided between blacks and whites (16 in each group), with a single biracial mother.

The 33 infants had an average CA of 8 months, with a range from 1 to 19 months. There were 16 black, 14 white, and 3 biracial children. Of the 33 infants, 16 were females and 17 males. The mean language and cognitive pretest scores of this sample indicated a predominance of developmental delay (Table 1).

Insert Table 1 about here.

For the purpose of data analysis, mother-infant dyads were divided into groups by the mother's pretest position (i.e., facing, partially facing, or behind the child). This grouping resulted in no significant group differences on any of the following demographic variables: CA, race, sex of infant, marital status, mother's education. However, protective service status approached significance ($p < .06$) and, thus, there may have been a tendency for protective service mothers to use the behind position more than non-protective service mothers.[1]

Measures

Child development. The cognitive and language

scales from the Developmental Skills Assessment (Crittenden, Note 2; Crittenden & Snell, Note 3) were used to assess the infants' abilities in these two areas. A total of 234 items (based on items from standardized tests) were applicable to infants below 24 months of age. A developmental quotient in language and cognitive skills was computed for each child by dividing the developmental age, corresponding to the total number of items passed, by the child's CA (Table 1). A total of seven staff members completed the developmental assessments, although the majority were done by the first author. Inter-rater reliability using an item by item comparison was .94.

Interactional behavior. Four one-minute videotapes of play interactions were obtained for each mother-infant dyad, two made during the first week of contact, and two made during the last week of contact, four weeks later. Coded observations were recorded at 3-second intervals for 20 consecutive intervals. The frequency of 15 variables was coded for both mother and infant. The videotapes were made at the center immediately before the mother group meeting. Upon arrival each dyad entered a classroom containing a 44 x 44 inch blanket and a variety of toys nearby. The

mother was instructed to play with her infant on the blanket while being videotaped. She was permitted to choose the placement of both her infant and herself.

Observers coded the tapes at a later time. Each observer received training from the first author on practice tapes until behavior by behavior inter-rater reliability was consistantly above .80. Thereafter, observers coded the videotapes independently. Random spot checks were used as well as scheduled reliability checks. Whenever inter-rater reliability dropped below .80, the training procedure was reinstated. The observers were three undergraduate psychology students who did not know the mothers or the hypotheses being tested. Mean inter-rater reliability using interval by interval frequency comparisons for occurrences (but not for non-occurrences) was .83.

The variables analyzed in this study were (a) the number of vocalizations; (b) the number of smiles; (c) the number of instances of mutual eye contact; and (d) the sum of all coded interactive behaviors except three avoidance categories. In addition, the mother's position (facing, partially facing, or behind) was coded.

Procedure

As mentioned earlier, the weekly meetings were

directed toward teaching a group of mothers of severely disadvantaged infants to analyze and improve their own interactional patterns. Videotapes, taken weekly of each dyad, provided the subject matter for observation and discussion. After videotaping, all infants were moved to a separate room for child care, while the mothers met as a group for an hour and a half. While the groups were somewhat unstructured, the agenda always included (a) viewing the brief videotapes taken of each dyad; (b) informal discussion related to the tapes; (c) an observation or role play activity related to mother-infant interaction; and (d) informal discussion on parenting issues of interest to the group. At times the observation activity consisted of watching a tape and stating aloud or checking on a simple checklist when various mother or infant behaviors occurred. During other meetings, mothers role-played the interactions of mother and infant. During the four months of intervention, particular attention was directed toward understanding how the mother's position influenced the mother-infant interaction pattern.

The study was designed to investigate the effect of the mother's position in two ways. First, mothers were grouped by their position (facing, partially facing,

and behind) during interaction. This was done separately for pre-test (first week of contact) and post-test positions (four months later).

Second, the change in the mothers' position from pre- to post-test was examined. The groups consisted of (a) mothers who used a facing position at both pre- and post-test; (b) mothers who improved their position to one of greater visual contact from pre- to post-test; and (c) mothers who maintained a non-facing position or changed to one of less visual contact. One-way analyses of variance were used to determine whether maternal position and maternal change in position were related to frequencies of interactive behavior and infant developmental quotients. Each dyad was assessed twice (at pre-test and post-test). Pre-test data consisted of demographic variables, a language and a cognitive developmental quotient, and two coded videotapes. Post-test data, collected four months later, consisted of a second language and cognitive developmental quotient and two more coded videotapes.

Results

As predicted, the mother's position relative to her infant was found to be significantly related (a) to the frequency of most of the maternal behaviors

observed and (b) to the infants' language and cognitive developmental quotients. Furthermore, the change in the mother's position relative to her infant from pre-test to post-test was related to (a) change in her interaction behavior and (b) change in her infant's developmental rate, favoring the facing position.

Effect of mother's position. A series of t-tests revealed no significant intradyad differences between the two pre-test videotapes or between the two post-test tapes. Therefore, in all additional analyses these observations were averaged in each respective period.

One-way analyses of variance indicated that at both pre-test and post-test the mother's position was significantly related to her frequency of vocalization and total interactive behavior. Maternal eye contact was significant for only the pre-test data. Maternal smiles followed the same trend but were a very low frequency behavior and did not reach significance. Infant language and cognitive developmental quotients were significantly related to maternal position in both periods. These results are shown in Table 2.

Insert Table 2 about here.

Tests for linear trends were significant in all cases where the overall analysis was significant. In addition, either the partial/facing or the partial/behind contrast was significant, but not both.

Effect of mother's change in position. First a chi-square test revealed a significant change in the position group distribution (facing, partially facing, and behind) from pre-test to post-test, $\chi^2(2) = 22.01$, $p < .001$. Further examination of these differences was completed using one-way analyses of variance on post-test interaction variables and child developmental variables by maternal position change groups (consistently facing position, improvement in position, and consistently non-facing or deterioration in position). Table 3 reports the F ratios for the dependent variables. Maternal vocalizations, eye contact, and total interactional behavior and infant language and cognitive developmental quotients were significant.

Tests for linear trends were significant for either the improve/facing or the improve/no change contrasts, but not both. None of the behaviors in any of the above analyses differed as a function of sex.

Further one-way analyses using the amount of increase or decrease in both interactional behaviors and developmental scores were significant only for the infant's cog-

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Insert Table 3 about here.

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nitive quotient, $F(2,30) = 5.39$, $p < .010$.

Discussion

The mother's position during play interaction with her infant was clearly related to the frequency of her interactional behavior and to her infant's language and cognitive developmental quotients. Infant behaviors for 22 of the 33 infants were assessed in a similiar manner to the mothers. The mean frequencies followed a trend similiar to that obtained for maternal behaviors, but, with the exception of mutual eye contact, did not reach significance and consequently were not reported in detail. In all cases, the results were most favorable for the facing position and least favorable for the behind position.

In addition, the mother's change in position following four months of intervention was related to her post-test interactional behavior and to her infant's post-test developmental quotients. The results favored those mothers who maintained the facing position or who improved their position. These results do not show a direction of effects for the original position choice. Therefore, it is not known whether behind position mothers stimulate their infants less and, therefore, induce delay, or whether delayed infants respond less, thereby reducing

maternal involvement. However, the change of position data suggested strongly that the mother was able to change the dyadic pattern by changing her own behavior. The amount of change in interactive behavior frequencies and developmental quotients seemed to be determined most by two factors: the mother's post-test position and the deviance of her pre-test behaviors and her infant's pre-test developmental quotients from the post-test maternal position group mean. In other words, when the dyad's pre-test scores were far below their post-test group means, the increases in the mother's interactive behaviors and the infant's developmental ratio were dramatic. However, when the pre-test scores were relatively similar to the post-test group means, the increases were more modest.

The data presented support the study's major hypotheses. However, several issues remain. First, because this was not an experimental study, mothers could not be assigned to position groups randomly. Neither, for ethical reasons, could some dyads be assigned to a non-intervention control group. Self-selection effects, therefore, could not be controlled adequately. The data were analyzed for the effects of demographic variables on position and change groupings and no effects were found. Nevertheless, the fact that not all mothers

showed equal improvement demonstrated that some differences existed among the subjects. Since some of the more severely at-risk dyads made progress, while others did not, it must be assumed that motivational factors, rather than severity of the problem, differentiated the dyads. Data were gathered on maternal attachment and these may provide useful explanatory information. Time may also have been a factor as some mothers who did not make progress in this four month period did show improvement over a longer period of time than was used in this study. These factors warrant further study.

A second issue concerns the stability of maternal behavior in the videotaped interactions. The position variable is useful only if it can be shown that individual mothers tended to use one position regularly. T-test results on the two tapes taken one week apart during the pre- and post-test periods supported the conclusion that maternal behaviors were stable within single week time periods. Of the 33 mothers, 22 used the same position on both pre-test tapes and 22 on the post-test tapes. In addition, if maternal position were unstable, it is highly unlikely that a significant relationship would exist between position and infant developmental quotients.

A related issue is the validity of the videotapes as a measure of maternal interactional behavior. It is possible that mothers behaved atypically due to the stress of being videotaped or as a result of a misinterpretation of directions given them. However, even if their videotaped behavior was an artifact of the testing situation, it nevertheless represented consistent differences among the mothers. Again, the finding of significant developmental differences based on maternal position among the infants supports this conclusion. In addition, stress or misinterpretation of directions is not an adequate explanation of maternal behavior at post-test. Four months of videotaping, instruction, and practice would have removed these as factors. Consequently, the differences in position, behavior, and development existing at post-test confirm the hypothesis that the mother's interactive behavior, as seen on the videotape, was indicative of her general pattern of interaction with her infant.

Conclusions

The results indicated that face-to-face communication was indeed very important for infant development, but that a significant number of high risk dyads did not use it often. Moreover, even so crude an intervention as manipulating the mother's position once a week

had effects on both her interactional behavior and her infant's development. While the results did not delineate the means by which such changes occurred, two processes are suggested. First, by facing their infants the mothers not only provided them with more immediate stimulation, but, through observation of their infants, the mothers also became more sensitive to the infants' needs and preferences and thus could arrange their environments more suitably. Second, in the facing position, it became possible for the infants to respond to and thereby reinforce their mothers' appropriate stimulating behavior. Thus, reciprocal patterns of stimulation and reinforcement were initiated by the intervention and maintained by the dyads.

The authors are well aware of the fact that maternal position constituted a very global measure of qualitative differences in interactional patterns. However, it may be a relevant variable for some high risk dyads. Moreover, it has the advantage of being easily assessed and manipulated by interventionists and of being easily understood and implemented by high risk mothers. While such intervention will not prevent the need for many supportive services to high risk families, it may reduce some of the immediate effects of severe disadvantage, neglect, or abuse.

Reference Notes

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Footnote

[1]This effect was not present when the same analysis was repeated using the mother's change position group; protective service mothers were as likely to show improvement in their position as other mothers. No demographic variables distinguished the change groups. Moreover, a regression analysis indicated no significant combination of demographic variables which distinguished the groups.

TABLE 1

Pre-Test and Post-Test Cognitive and Language Developmental Quotients*

N = 33

Test	Mean	Standard Deviation	Range
Pre-Test Language Developmental Quotient	.89	.19	.50-1.25
Post-Test Language Developmental Quotient	1.00	.17	.50-1.30
Pre-Test Cognitive Developmental Quotient	.77	.20	.25-1.00
Post-Test Cognitive Developmental Quotient	.97	.13	.50-1.30

*A quotient of 1 indicates a normal or expected rate of development (Crittenden, Note 2).

TABLE 2

One-Way Analyses of Variance for Pre-Test and Post-Test Dependent Variables as a Function of Mother's Position

N = 33

Variable	Mean Square	F(2,30)	p<
Mother's Vocalizations			
Pre-Test	187.00	6.29	.005
Post-Test	170.87	5.23	.011
Mother's Smiles			
Pre-Test	0.82	2.74	.080
Post-Test	1.65	1.50	.239
Mother's Eye Contact			
Pre-Test	36.50	3.21	.054
Post-Test	36.15	1.83	.178
Mother's Interactive Behavior			
Pre-Test	574.18	6.53	.004
Post-Test	478.39	4.07	.027
Child's Language Quotient			
Pre-Test	0.24	10.24	.000
Post-Test	0.13	5.84	.027
Child's Cognitive Quotient			
Pre-Test	0.38	18.33	.000
Post-Test	0.05	3.37	.048

TABLE 3

One-Way Analyses of Variance for Post-Test Dependent Variables as a Function of Change in Mother's Position

N = 33

Variable	Mean Square	F(2,30)	p<
Mother's Vocalizations	151.50	4.46	.020
Mother's Smile	2.30	2.17	.131
Mother's Eye Contact	158.08	3.17	.056
Mother's Interactional Behavior	527.33	4.62	.018
Child's Language Quotient	.09	3.71	.036
Child's Cognitive Quotient	.05	3.33	.049